opening, as seen in FIGS. 3 and 5, since the controlled direction of the bend 60, as well as the controlled length of the bend 60, will create a parallelogram 14 of the grid 10, as seen in FIG. 3 from the rectangular layout of the grid 10 previous to the fire, as seen in FIG. 12.

In the rectangular grid 10, as seen in FIG. 2, the equal length diagonal lines 17 represent the equal distance from opposing corners in a rectangular opening. In the parallelogram 14 of FIG. 3, one of the diagonals 16 is slightly shortened and one diagonal 18 is slightly lengthened, so that a grid opening continues to be capable of supporting the panel 11. As seen in FIG. 4, the diagonals in a prior art opening that sometime occurred, are either both lengthened as at 63, or both shortened as at 64, resulting in an enlarged opening or reduced opening no longer capable of supporting the panels 11.

The parallelogram 14 is still adequate to retain the panel 11 in a grid opening 15, since a panel 11 is generally slightly smaller than that formed by the webs 25 of the grid 10 defining an opening. Thus, in the parallelogram 14, the main beams 20 continue to extend parallel to one another at a four foot spacing, since the expansion of a main beam 20 is accommodated by cut-outs, as explained above.

The slight shift into a parallelogram 14 that occurs with the controlled bends 60 of the connector of the invention does not destroy the continued support of the panel 11 by the flanges of the cross beams 26, 27, and there is no undue interference by the webs of the cross beams against the panel 11 edges.

By limiting the bend 60 of the connector 21, 22 of the invention to less than the prior art bend which occurred at the rivet point 29 in a prior art connector, as occurred in the prior art as shown in FIGS. 4, 6, and 7, the deviation of the cross beam 26, 27 from a rectangular grid 10 will be less.

Still another advantage of the present invention is that the compressive force at which the connector 21, 22 bends can be controlled. The deeper the V-shaped indent into the bottom angled flange 72, which results in a greater height of the indent 50 above bottom flange 73, the less the force that is necessary to bend the connector 21, 22. The actual depth can readily be determined through slight experimentation, since the thickness and composition of the metal from which the connector is formed is a factor that must be considered in establishing the depth of the indent. It is desirable to have the connector bend at a bend line 80 on the indent at about a force of 100 pounds.

Operation

A suspended ceiling 9 having connections 19 of the invention, is shown under normal circumstances in FIGS. 1 and 2, wherein cross beams 26 and 27 and main beams 20 form a grid 10. The grid 10 has rectangular openings 15 that support panels 11 on flanges of the grid beams. The beams are connected through the connections 19 as also shown in FIGS. 8 and 10. The connection 19 of FIGS. 8 and 10 is that shown in the '323 application with the improvement of the present invention.

As seen in FIG. 2, the grid openings 15 form rectangles having equal diagonal lengths 17, wherein the connections 19 at the intersection of the beams form right angles of the main and cross beams. The rectangular panels 11 are supported in the rectangular openings 15 created by such right angle connections.

In the event of a fire, expansion forces are built up in the main beams 20 and the cross beams 26 and 27 from the heat of the fire, and unless these forces are relieved, the beams will buckle, allowing the panels 11 to drop out of the grid 10, and permitting the heat of the fire to attack the structural ceiling.

In the grid 10 using the connections 19 of the invention, the cutouts in the main beams 20 permit the main beams 20 to expand by folding longitudinally at the cutouts, so that the main beams 20 remain parallel to each other in the grid 10.

The cross beams 26 and 27 are permitted to expand by the connectors 21 and 22 bending at the V-shaped indents 50 in a direction as seen particularly in FIGS. 3 and 12. This controlled expansion of the cross beams 26 and 27, results in a slight parallelogram 14 as seen in FIG. 3, which continues to support the panels, as seen in FIG. 5. The connectors 21 and 22 bend 60 in a controlled direction at a predetermined force at a predetermined bend line 61, so that the ceiling remains intact during a fire.

In the prior art, a ceiling 9, as seen from below in FIG. 4, that has been exposed to a fire, has connectors that have been bent from expansion forces, as seen in FIG. 13. The bends 56 which occur along bend lines 55 at the rivet holes 29, which are the weakest part of the connector. The bends can occur in different directions, which in turn create expanded rectangular openings, seen in the upper part of FIG. 4, or reduced rectangular openings, as seen in the lower part of FIG. 4, causing the panel to crumble, as seen in FIG. 7, and drop out of the opening. The prior art bends 56 may require such a great force so that the cross beam buckles before the bend 56 occurs, or the bend 56 may occur at such a low force that the required stiffness to have the grid continue to support the panels does not exist.

In the present invention, the connectors 21 and 22, with indents 50, as set forth above, create bend lines 61 that create bends 60 in the event of a fire that form parallelograms of the grid openings that continue to support the panels 11 to keep the ceiling intact. Such an intact ceiling protects the structural ceiling from the heat of the fire.

What is claimed is:

1. In a stab-in connector for a cross beam in a grid of a suspended ceiling, wherein the grid supports panels in rectangular grid openings:

the connector having a top and a bottom angled flange extending outwardly at its top and at its bottom, respectively,

the improvement comprising

the connector with an indent, wherein the indent is formed v-shaped in the bottom angled flange with a height above the surface of the bottom angled flange.

2. The improvement of claim 1 wherein the depth of the indent controls the force at which a bend occurs, along the bend line, from expansion forces created by a fire.

3. The improvement of claim 1 wherein the indent controls the direction in which the bend occurs.

4. The improvement of claim 1 wherein the bend, during a fire, permits grid openings in the grid to change from a rectangular shape to a parallelogram shape, wherein, in such change, opposing main beams remain stationary and opposing cross beams shift to a diagonal position, whereby the panels continue to be supported in the grid openings.

5. The improvement of claim 1 wherein the connectors bend at a force of about 100 pounds.

6. The improvement of claim 1 wherein the cross beams and main beams have stitching in their webs to strengthen the beams.

7. The improvement of claim 1 wherein the indent is located vertically in line with a hole in the connector.

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